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Report to Congressional Committees

August 1996

U.S. COMBAT AIR POWER

Aging Refueling Aircraft Are Costly to Maintain and Operate

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National Security and
International Affairs Division

U.S. COMBAT AIR POWER
AGING REFUELING AIRCRAFT
ARE COSTLY TO MAINTAIN AND
OPERATE

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Congressional Committees

Due to the changing nature of defense operations, the demands on the services' air refueling fleet have not diminished since Operation Desert Storm. However, the Air Force's principal tanker aircraft—the KC-135s—are 30 to 40 years old and, as a result, are taking progressively more time and money to maintain and operate. Nevertheless, the Air Force has no immediate plans to replace the KC-135s as it currently considers the replacement of other aircraft a higher priority. Additionally, because of the demands on the tanker fleet, Air Force active and reserve air refueling personnel have been stressed to satisfy mission needs.

We examined the services' air refueling needs, the cost to operate and maintain the air refueling fleet, and the impact that the air refueling missions have on the active and reserve forces. This report contains a recommendation to the Secretary of Defense concerning future aircraft procurement that provides an opportunity to enhance operational flexibility by acquiring a dual-use aircraft that combines airlift and refueling capabilities.

This report was part of our broader effort to assess how the Department of Defense might better adapt its combat air power to meet future needs. We are addressing this report to you because of your responsibility for the issues discussed and your interest in the subject.

Please contact me at 202-512-3504 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix IV.

Richard Davis

Richard Davis
Director, National Security
Analysis

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Executive Summary

Purpose

Air refueling extends the operational range of the military services' aircraft, increases combat capabilities, and enhances commanders' flexibility in the use of aircraft. During Operation Desert Storm, the Air Force routinely refueled Navy, Marine Corps, allied, and its own aircraft. Since then, because of contingency and other operations, the demands on the tanker fleet have not diminished, even though the services have downsized in many other areas. During this review, GAO examined the services' air refueling needs, the cost to operate and maintain the air refueling fleet, and the impact that the air refueling missions have on the active and reserve forces. This report is one of a series of reports assessing how the Department of Defense (DOD) might better adapt its combat air power to meet future needs. Other reports in this series address close fire support, interdiction, air superiority, suppression of enemy air defense, and surveillance and reconnaissance.

Background

The Air Force, Navy, and Marine Corps operate almost 900 tanker aircraft, most of which are derivatives of cargo or commercial aircraft. The Air Force owns about 690 of them, divided nearly equally between active and reserve forces. The Air Force's KC-135 fleet of about 550 aircraft refuels Navy, Marine Corps, and Air Force combat aircraft, strategic bombers, command and control aircraft, and airlift aircraft. The Navy's S-3 refuels Navy and Marine Corps aircraft during their launch from and recovery aboard aircraft carriers, and the Marine Corps' KC-130 refuels Marine fighters and helicopters. The U.S. Air Force Special Operations Command refuels special operations helicopters with its HC-130s and MC-130s. Tanker aircraft also airlift passengers and cargo. Over the next 6 years, the services estimate they will spend about $2.4 billion a year to operate these aircraft.

Results in Brief

Although the services' air refueling tanker aircraft meet current needs, satisfying future requirements may be difficult. The long-term serviceability of the KC-135 tanker fleet is questionable, because the aircraft are 30 to 40 years old and, as a result, are taking progressively more time and money to maintain and operate. Furthermore, the Air Force could spend over $6 billion in modifications and structural repairs to keep the KC-135 fleet operational. Even though the Air Mobility Command doubts that the KC-135 can be economically operated beyond 2020, it does not plan to begin to replace them until around 2013, which is 6 years later than planned a year ago. The Command deferred the replacement program because it considers replacement of the C-5A transport beginning in 2007 a

higher priority. However, the Air Force must eventually replace the KC-135. As the Air Force makes plans for replacing its C-5A, it has an opportunity to enhance operational flexibility by acquiring a dual-use aircraft that combines airlift and refueling capabilities. Current tankers have demonstrated the versatility and value of a dual-use aircraft. For example, the KC-10, a derivative of the commercial DC-10, was acquired as a dual-role aircraft and the KC-135 is increasingly used to transport high-priority cargo and passengers. The Air Force now plans to buy both a new transport aircraft to replace its C-5A plus a new tanker later to replace the KC-135. Since tanker aircraft are frequently used as cargo aircraft, a dual-use aircraft is a viable option.

In recent years, Air Force active and reserve air refueling personnel have been stressed to satisfy mission needs. As a result, active duty tanker crews have approached the Air Force Chief of Staff's management limit that active duty crews should not be away from their home bases on temporary assignments more than 120 days a year. In fiscal years 1994 and 1995, the deployment rates for individual tanker crew positions, particularly navigators, approached the 120-day management limit, ranging from 103 to 117 days, depending on crew position. To stay below the 120-day limit and relieve pressure on active duty tanker crews, the Air Force has looked to the air reserve units to take on more of the tanker workload in a role not originally envisioned for reserve forces. Air Reserve Components flew 27 percent of the total sorties and 30 percent of the total flying hours flown by the Air Mobility Command and the Air Reserve Components during fiscal year 1993. This increased in fiscal year 1995 to 44 percent of the sorties and 49 percent of the flying hours flown by the Air Mobility Command and the Air Reserve Components. Currently, the reserve force can maintain this level of operations because many crew members volunteer extra time, thus exceeding the reserves' legal training requirement of 38 days a year. Many, in fact, have served over 100 days a year for training and flying sorties. This effort is in addition to maintaining their civilian jobs. According to service officials, these units are now operating at about 95 percent of their potential availability.

Principal Findings

The Aging Tanker Force Is More Difficult to Maintain

The KC-135 tankers, many of which are 40 years old, are the oldest aircraft the services operate and are becoming more expensive to operate

(the cost per KC-135 flying hour is projected to increase from $8,662 in 1996 to $10,761 in 2001). The military has little or no experience operating and maintaining aircraft of this age, and there are no commercial airline fleets of a comparable age. Consequently, the Air Force only recently began to collect data to enable it to predict how long or effectively these aircraft can continue to operate.

As the KC-135 tankers age, they require more maintenance, reducing the number of aircraft available for operations. For example, between fiscal years 1991 and 1995, the labor hours planned to complete depot overhauls of the KC-135s increased by about 36 percent and the average time the aircraft spent in the depot increased from 158 days to 245 days. According to Air Force officials, the growth in planned work included time to apply corrosion preventive compounds and rewire significant portions of each aircraft. In addition, shortages of spare parts, that were no longer in production or stocked, and unplanned work, required to correct structural corrosion and fatigue, contributed to maintenance delays and reduced aircraft availability.

The Air Force could spend over $6 billion for a variety of modifications and structural repairs to improve the reliability, maintainability, and capability of its KC-135s. These include re-engining KC-135Es, replacing major structural components because of their age or susceptibility to stress corrosion, adding a multipoint refueling capability to some of the aircraft, relocating the navigator's instruments to the pilot and copilot positions, installing improved compass and radar systems, installing a global positioning system, and adding a ground collision avoidance system. Of these potential modifications and repairs, the Air Force has funded about $390 million for relocating the navigator's instruments and installing the global positioning system and the improved compasses and radars. According to Air Force officials, these modifications and repairs should reduce maintenance costs and increase the aircraft's capability. The Air Force has also funded a $204 million program to modify about 45 KC-135 tankers with a multipoint capability to enhance their ability to refuel Navy and Marine aircraft. The Desert Storm air campaign and other operations illustrated both the feasibility and necessity of cross-service air refueling operations. For example, during Operation Desert Storm, Air Force tankers supported Navy, Marine Corps, allied, and their own aircraft. However, adapters had to be installed on the Air Force tankers in order to refuel Navy, Marine Corps, and allied aircraft. This complicated joint mission planning because properly configured tankers had to be available to fill each service's special needs.

Though currently unfunded, the Air Force may also need up to $600 million to overhaul or upgrade about 600 engines for the KC-135s. Even when overhauled, however, these engines will not meet Federal Aviation Administration and international noise and air pollution standards that become effective by 2000. As a result, the aircraft may not be allowed to operate from some airfields, or their operations may be restricted.

Aging Tanker and Airlifter Forces Provide an Opportunity to Acquire a Dual-Use Aircraft

Even though the Air Mobility Command has delayed consideration of a replacement of the KC-135 from fiscal year 2007 to 2013 while accelerating the replacement of the C-5A transport aircraft beginning in 2007, the aging KC-135 tankers must ultimately be replaced.[1] The anticipated acquisition of a C-5A replacement aircraft may provide an excellent opportunity to satisfy both airlift and tanker needs. Current tankers have demonstrated the versatility and value of a dual-use, airlift-tanker aircraft. For example, the KC-10, a derivative of the commercial DC-10, was acquired as a dual-role aircraft. It demonstrated the viability of that concept during Desert Shield/Storm during which it off-loaded almost 300 million pounds of fuel (about 25 percent of the total) and transported about 54 million pounds of cargo and about 6,700 passengers. Similarly, the KC-135 is increasingly used to transport high-priority cargo and passengers. The Air Mobility Command allocates 26 of these aircraft to wartime airlift tasks. In addition, some foreign nations have converted commercial aircraft built by U.S. companies to provide air refueling capabilities for their military aircraft.

Peacetime Activities Have Increased Demands on the Tanker Crews

The relocation of U.S. forces from overseas bases to the United States and the increasing U.S. involvement in contingency and other peacetime missions have increased the demands for air refueling. While the number of tactical aircraft needing refueling is declining, as is much of the military force, tanker support is increasingly required. The drawdown of U.S. forces from overseas bases has added to refueling requirements because of the need to refuel U.S.-based tactical aircraft, enabling them to reach and return from their overseas destinations and to facilitate their performance and sustainment once they are in place. As a result, active duty tanker crews have spent nearly 120 days a year on temporary assignments away from their home bases. The Air Force Chief of Staff's

[1]The Air Force does not plan to replace the KC-135 at this time because, it says, it cannot afford to simultaneously acquire a replacement tanker, the C-17, a replacement for the C-5A transport aircraft, and a new tactical aircraft such as the F-22.

management limit is that its members not spend more than 120 days a year on temporary assignments.

To stay below the 120-day temporary duty level and relieve pressure on active duty tanker crews, air reserve units, which currently maintain more than half of the KC-135 fleet, have taken on more of the tanker workload in a role that was not originally envisioned for the Air Reserve Component. As a force originally intended to augment the active Air Force in time of war or national emergency, Air Reserve Component personnel are legally required to serve 38 days a year for training in peacetime: one weekend a month and 2 weeks of annual active duty for training. However, Air Reserve Components flew 27 percent of the total sorties and 30 percent of the total flying hours flown by the Air Mobility Command and the Air Reserve Components during fiscal year 1993. This increased in fiscal year 1995 to 44 percent of the sorties and 49 percent of the flying hours. According to senior officials, the Air Reserve Component units are now operating at about 95 percent of their potential availability. While reserve crew members cannot be required to serve more than 38 days a year, many volunteer extra time. According to Air Force Reserve officials' data, many crew members, in addition to meeting the demands of their families and their civilian employers, averaged more than 100 days a year supporting their units' training requirements and air refueling sorties. Thus, the Air Force is able to support peacetime tanking requirements in large part because of the high tempo of active forces and the volunteerism in the Reserve Components.

Recommendation

Because the services have successfully used dual-role aircraft for both air refueling and airlift missions, GAO believes that a dual-use replacement aircraft could fulfill both airlift and air refueling missions. Accordingly, GAO recommends that the Secretary of Defense require that future studies and analyses of replacement airlift and tanker aircraft encompass both mission areas, with the goal to identify the optimum size, mix, and time to procure a multimission aircraft that, when combined with C-5Bs, C-17s, and KC-10s, will meet those requirements. Such an aircraft would eliminate the need to acquire two aircraft types, one for airlift and the other for refueling.

Agency Comments

In its comments on a draft of this report, DOD wrote that the report accurately portrays some of the challenges facing the KC-135 fleet in the coming years. It also said that it believes the current force structure can

adequately meet requirements for the foreseeable future and agreed that future studies and analysis of replacing refueling and airlift aircraft should include an analysis of using one aircraft to accomplish both missions. It acknowledged that it was successful in using a single aircraft, such as the KC-135 for both airlift and refueling. However, DOD said that it could not commit to a dual-use replacement aircraft until a study including operational issues is completed. GAO agrees that such analysis should be conducted before a decision is made. DOD did not comment on the stress of peacetime activities on tanker crews in its written response. (See app. I.)

Contents

Abbreviations

AFRES	Air Force Reserve
AMC	Air Mobility Command
ANG	Air National Guard
ARC	Air Reserve Component
DOD	Department of Defense
FYDP	Future Years Defense Program

Introduction

The Air Force, Navy, and Marine Corps tankers provide refueling support to both land- and carrier-based aircraft. Tankers extend the operational range of aircraft, enable aircraft to carry larger loads, increase combat tempos, and enhance commanders' flexibility. As world conditions have changed, so has the role of the tanker. While the Air Force's tankers were once principally intended to support strategic bombers, the tanker fleet is now responsible for various air refueling tasks in support of both peace and wartime missions. Although each service has its own specific air refueling needs, cross-service refueling operations have become increasingly important, as illustrated in Operation Desert Storm when Air Force tankers routinely refueled Navy, Marine Corps, and allied aircraft in addition to its own. Tankers also carry passengers and cargo. The cost to operate the tanker fleet will average about $2.4 billion a year between fiscal years 1996 and 2001.

The Current Tanker Fleet

The Air Force, Navy, and Marine Corps currently operate almost 900 tanker aircraft (see table 1.1). The Air Force owns about 690 tankers, or about 78 percent of the entire fleet, and is primarily responsible for land-based peacetime and wartime refueling operations. Before Operation Desert Storm, most of the Air Force tanker fleet was in the active force. Today, however, about 50 percent of the overall Air Force tanker fleet is operated by the reserve forces.[1]

Table 1.1: Services' Tanker Aircraft and the Aircraft They Support

Service	Model	Quantity	Aircraft supported
Air Force			
	HC-130	67	Special Operations Command helicopters
	KC-10	59	Tactical aircraft/strategic bombers/transports
	MC-130	14	Special Operations Command helicopters
	KC-135	552	Tactical aircraft/strategic bombers/transports
Marine Corps			
	KC-130	74	USMC helicopters/tactical aircraft
Navy			
	S-3	118	Carrier-based tactical aircraft
Total		**884**	

[1]As discussed in ch. 3, the reserve forces operate 54 percent of the KC-135s.

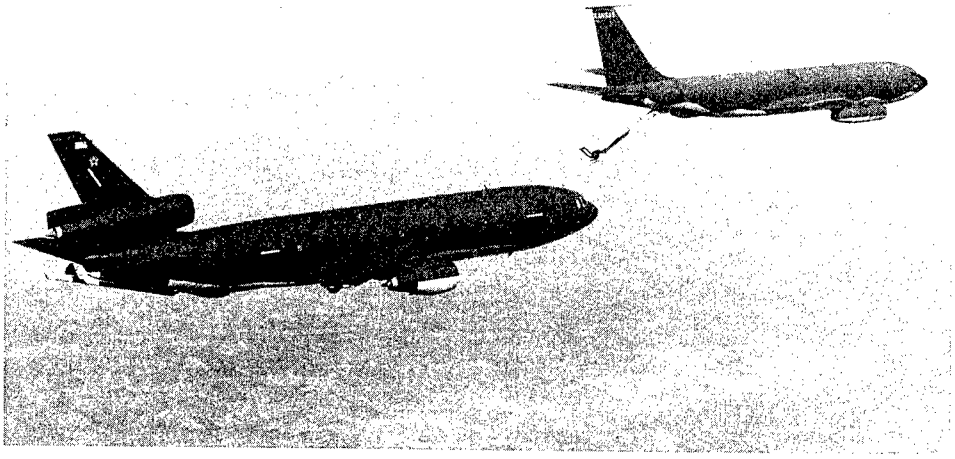
Tankers' Evolving Support Role

The current tanker fleet has evolved from post-World War II requirements to contain Soviet military power. During the Cold War era, the role of the KC-135 was to refuel strategic bombers that would carry out the strategic nuclear war plan. Support of the plan remained the KC-135s' primary mission until the demise of the Soviet Union and the resultant reduction in the strategic threat. Tankers were also used to support tactical operations: first during the Vietnam conflict and later during Operations Desert Shield and Desert Storm. As the threat changed, so did the role of the tanker. Today, under the Department of Defense's (DOD) Planning Guidance, the KC-10/KC-135 fleet is required to support operations in response to major regional conflicts and the strategic nuclear war plan. However, tankers are increasingly being tasked to support contingency and other missions as both tanker and cargo aircraft.

Refueling Tasks

Refueling aircraft as they deploy to and operate from overseas locations is one of the major tasks of the tanker fleet. In-flight refueling allows tactical and airlift aircraft to travel longer distances with large cargo and passenger loads and also reduces the need for access to overseas bases, thus minimizing potential impediments to the movement of U.S. forces throughout the world. Because they can be refueled in the air, combat air forces within a theater can strike longer range targets or carry larger weapons loads than their normal fuel/weapons loads would permit and can remain airborne for longer periods of time. (Fig. 1.1 shows an Air Force KC-135 refueling a KC-10.)

Figure 1.1: Air Force KC-135 Refueling a KC-10

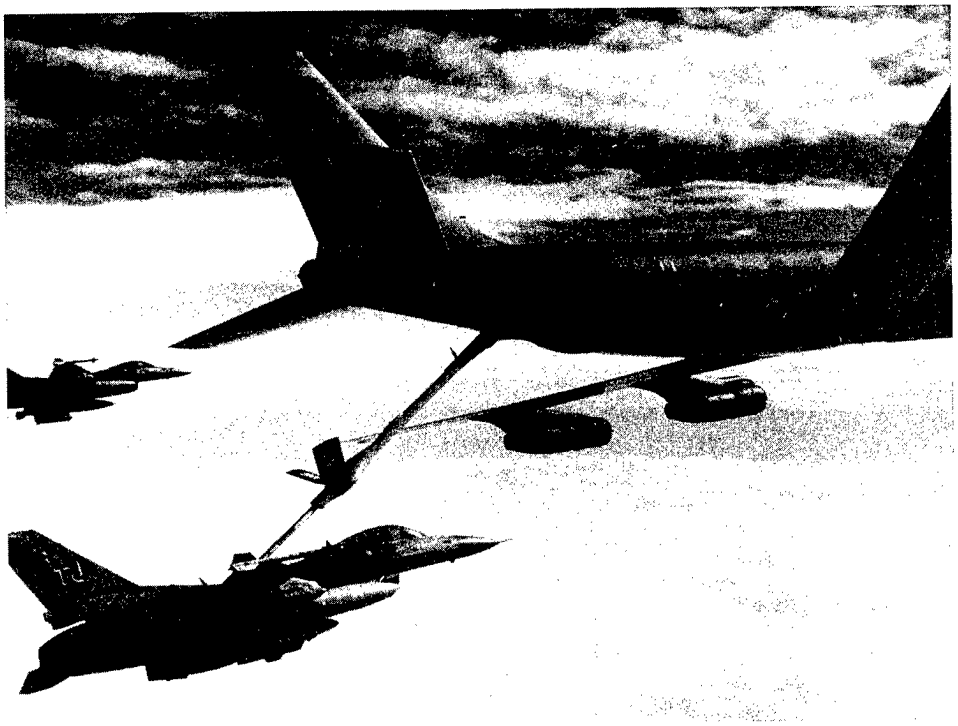


Source: DOD.

Because of the return of U.S. forces from overseas, as bases were closed due to downsizing, tankers are refueling more aircraft as they deploy to and operate from distant trouble spots. The reduced size of the U.S. force has made it necessary to rely more on joint operations involving mixed groups of U.S. Air Force, Navy, Marine Corps, and allied aircraft to capitalize on the unique strengths of each service. For example, during Operations Desert Shield and Storm, Air Force tankers transferred about 14 percent of 1.2 billion pounds of fuel to Navy and Marine Corps aircraft and about 2 percent to allied aircraft.[2] (Fig. 1.2 shows refueling in flight.)

[2]Allied aircraft were from Bahrain, Canada, Italy, Oman, Saudi Arabia, and the United Arab Emirates.

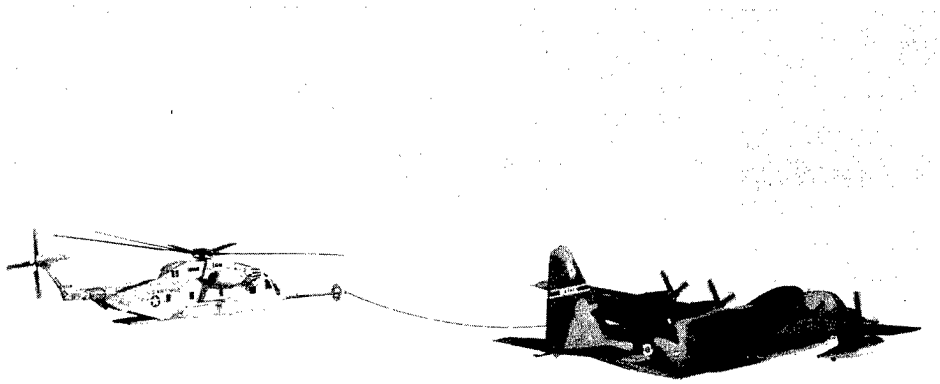
Figure 1.2: Air Force KC-135 Refueling an F-16



Source: Air National Guard.

Each service has other, specific refueling requirements. Air Force tankers are tasked to refuel strategic nuclear bombers, command and control aircraft, and combat search and rescue helicopters. The Air Force Special Operations Command also uses tankers to refuel both Air Force and Army special operations helicopters. Navy tankers support carrier-based aircraft and are critical to their safe recovery since alternate airfields are frequently not available. Marine Corps tankers support fighters and helicopters involved in expeditionary and crisis response operations. (Fig. 1.3 shows an Air Force HC-130 refueling a search and rescue helicopter.)

Figure 1.3: HC-130 Refueling an HH-53



Source: DOD.

Airlift Tasks

In addition to refueling missions, several types of tanker aircraft play significant roles in airlifting passengers and cargo. For example, to meet wartime requirements, the Air Mobility Command's (AMC) 1996 master plan allocates 37 KC-10s to airlift tasks and only 15 to air refueling. The nine remaining aircraft are for backup and training. In addition, the Air Force has increased its use of KC-135s to move high-priority cargo and passengers, allowing airlifters such as the C-141 to be dedicated to the tasks only they can accomplish. Between fiscal years 1993 and 1994, active Air Force KC-135 cargo flights increased about 47 percent. Through fiscal year 1995, the Air Force bought 150 roller kits to enhance loading and unloading cargo from the KC-135.[3] The master plan designates 26 KC-135s for wartime airlift requirements. Marine Corps KC-130s are also frequently used to transport passengers and cargo. For example, during Operation Desert Storm, KC-130s airlifted over 3,000 passengers and 8.1 million pounds of cargo.

Tanker Costs

Between fiscal years 1996 and 2001, the services' estimated annual operating costs for tankers are about $2.4 billion. Personnel costs account

[3]Because the KC-135 was designed as a tanker, it does not have rollers built into its floor as cargo aircraft do. The roller kits can be moved to KC-135s as they are needed for cargo missions.

for about 32 to 34 percent of costs, while operations and maintenance costs range from 55 to 61 percent. (See table 1.2)

Table 1.2: Funding for the Services' Tankers (fiscal year 1994-2001)

Dollars in thousands

	Fiscal year		
Appropriation	**1994**	**1995**	**1996-2001[a]**
Aircraft procurement	$114,418	$188,257	$1,281,823
Military construction	9,000	55,550	103,334
Military personnel	451,865	794,420	4,778,165
Operations and maintenance	1,194,893	1,431,964	8,484,022
RDT&E[b]	11,540	23,006	13,520
Total	**$1,781,716**	**$2,493,197**	**$14,660,864**

Note: Funding is based on the 1996 Future Years Defense Program (FYDP), which covers funding for the Air Force's KC-10s and KC-135s, all Navy S-3 missions, and the Marine Corps' KC-130s. The table does not include funding for the Air Force's H/MC-130 aircraft because they are not separately identified in the FYDP.

[a]Total for 6 years.

[b]RDT&E is research, development, testing, and evaluation.

Objectives, Scope, and Methodology

During this review, we examined the services' air refueling needs, the cost to operate and maintain the air refueling fleet, and the impact that the air refueling missions have on the active and reserve forces. This report is one of a series of reports assessing how DOD might better adapt its combat air power to meet future needs. Other reports in this series address close fire support, interdiction, air superiority, suppression of enemy air defense, and surveillance and reconnaissance.

To accomplish our objectives, we met with agency officials responsible for program management and obtained pertinent documents concerning the characteristics, missions, requirements, employment concepts, and associated costs of the tanker aircraft. We did not independently determine the reliability of the cost information. We also obtained information concerning the maintenance of and planned modifications to existing systems. We reviewed several studies and reports addressing these topics. In addition, we discussed air refueling issues with representatives of several research organizations and defense-related companies. When analyzing the problems of maintaining aging aircraft, we concentrated on the Air Force's KC-135 because it makes up about two-thirds of the DOD's tanker inventory.

To gain the operators' perspective of air refueling operations and requirements, we met with officials of three unified commands, various Navy and Air Force commands, and several tanker units. (See app. II for a list of locations we visited during our review.) During those visits, we discussed the commands' policies and procedures for using air refueling assets. We also observed flight and air refueling operations at several units and commands. We observed carrier flight operations aboard the U.S.S. Theodore Roosevelt during its predeployment training and discussed air refueling issues with air wing personnel. During Joint Training Exercise 95-2, we visited the Joint Force Air Component Commander aboard the U.S.S. Mount Whitney and observed how tanker use was integrated into the air tasking order planning process. During the exercise, we also visited the U.S.S. Theodore Roosevelt and accompanied the crew of a KC-135R from the 72d Air Refueling Squadron on a refueling mission to observe how those plans were executed. To gain a Special Operations Command perspective, we accompanied the crew of an HC-130 of the 9th Special Operations Squadron on a night helicopter refueling mission. We also accompanied the crew of a KC-135E of the 108th Air Refueling Wing on a refueling flight.

We performed our work from June 1994 to February 1996 in accordance with generally accepted government auditing standards.

The Services Have Deferred Plans to Replace Aging Tanker Aircraft

Although the services' tankers meet current Defense Planning Guidance requirements, meeting future requirements may be difficult. Most tankers, including all Air Force KC-135s, are 30 to 40 years old, and are increasingly more expensive and time-consuming to support. According to the Air Force, the cost per KC-135 flying hour is projected to increase by about 24 percent, from about $8,700 in 1996 to $10,800 in 2001. In addition, from fiscal year 1991 to fiscal year 1995, the average time KC-135s spent in the depot for scheduled maintenance increased from 158 days to 245 days. Furthermore, the Air Force may spend over $6 billion in the coming years to sustain the KC-135 fleet and improve reliability and capability. Despite the fact that costs to maintain and operate the KC-135s have increased and its availability has decreased, the Air Force has not estimated the KC-135's economic service life and determined when to begin replacing it. Nevertheless, AMC has delayed consideration of a tanker replacement from fiscal year 2007 to fiscal year 2013.

Tanker Fleet Meets Current Needs

According to recent Air Force and other studies, the current KC-10/KC-135 force is generally adequate to meet the requirement to support operations in response to major regional conflicts and the strategic nuclear war plan. This determination is based on the Defense Planning Guidance and current planning assumptions such as the number and types of aircraft to be supported, the arrival time of forces in the theater, the duration and nature of the operations, and the availability of air bases. According to Air Force officials, changes in any of these assumptions impact the tanker requirement. For example, the tanker requirement would increase significantly if U.S. forces were denied access to certain overseas air bases that are critical to supporting the deployment of U.S. forces. Conversely, requirements would decrease if the time frames for deployment were lengthened. In a recent study of tanker requirements, the Institute for Defense Analysis also noted that tanker requirements are very sensitive to variations in those types of factors.

However, because of the tankers' age, the services' ability to meet requirements over the long term may be a challenge. As table 2.1 shows, many of the tanker aircraft entered service in the 1960s and 1970s and, in the case of the KC-135, as long ago as the mid-1950s.

Table 2.1: Age of the Services' Tanker Aircraft

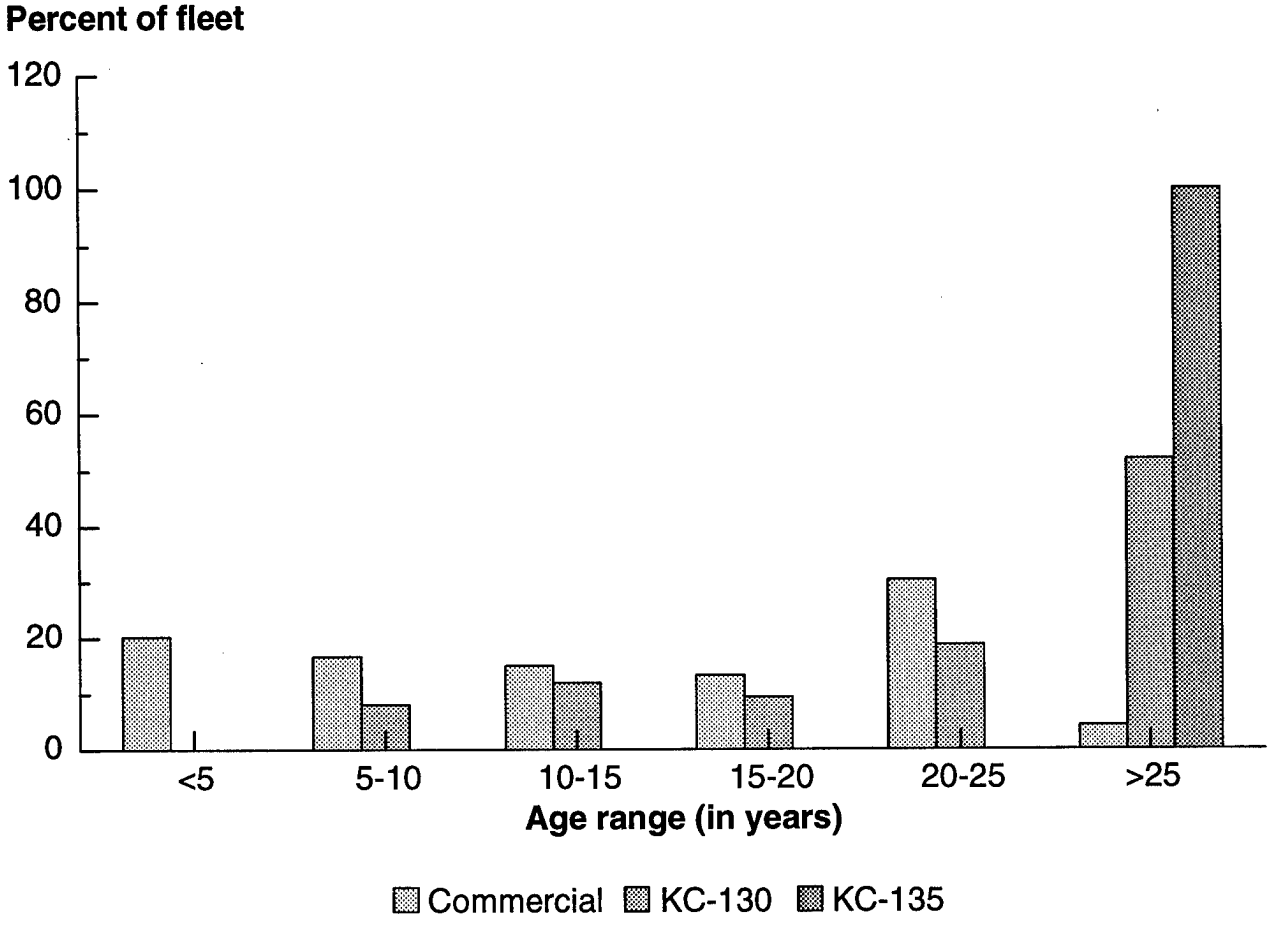
Aircraft	Service	Age (years)
H/MC-130	Air Force	27 to 32
KC-10	Air Force	6 to 15
KC-135	Air Force	31 to 39
KC-130	Marine Corps	18 to 36[a]
S-3	Navy	18 to 22

[a]KC-130s have been purchased more recently for the Marine Corps Reserve squadrons.

Source: GAO analysis of service data.

Compared to commercial aircraft, most military tankers are considerably older. As figure 2.1 shows, only about 4 percent of U.S. commercial aircraft will be 25 years or older by 2000, whereas all of the Air Force's KC-135s are already older, and by 2000, they will be 35 to 43 years old.

Figure 2.1: Aircraft Ages (year 2000)



Source: GAO analysis of Air Force data.

The Air Force has initiated a program that it hopes will enable it to determine the effects of corrosion on KC-135 structural life and estimate the aircraft's remaining economic service life. The Boeing Company, manufacturer of the KC-135, projected that the aircraft could fly for many years beyond the turn of the century, based on the average hours flown, and a projected utilization of about 300 hours a year per aircraft. This

projection, however, does not consider the effects of corrosion, widespread fatigue damage, and stress corrosion cracking on structural life, which can require major structural modifications and parts replacement.

In the commercial sector, aircraft are generally considered old when they reach the end of their economic design life—that lifespan over which their designers originally believed they could be operated economically. Economic life, which varies among different aircraft types, has generally been stated in terms of years in service, number of takeoffs and landings, and operating hours. Historically, when commercial aircraft reached the upper limit of one of these measures, they would have most likely been retired, generally before suffering the damaging effects of corrosion, incurring higher operating costs, and requiring increased maintenance. In recent years, however, air carriers have tended to keep older aircraft in service even though more time and money is needed to maintain them, in part to meet increased demands for air travel.

Expense and Time to Maintain Aging Tankers Have Increased

As shown in chapter 1, the costs to operate, support, and modernize DOD's tanker aircraft are projected at about $2.5 billion annually through 2001. The Air Force estimates that it will spend about $8.2 billion just for KC-135 direct operations and support during fiscal years 1997-2001. Because the KC-135s are older, they require more maintenance and longer stays in the depot during overhaul. As a result, fewer aircraft are available to the squadrons.

Increase in KC-135 Operating and Support Costs

According to an Air Force automated budget system, the cost per KC-135 flying hour is projected to increase by about 24 percent, from $8,662 in 1996 to $10,761 in 2001. Increased projected costs of people, fuel, and depot maintenance are the primary reasons for the higher cost per flight hour. Costs for personnel are projected to increase by about 12 percent, for fuel by 17 percent, and for depot maintenance by 60 percent.

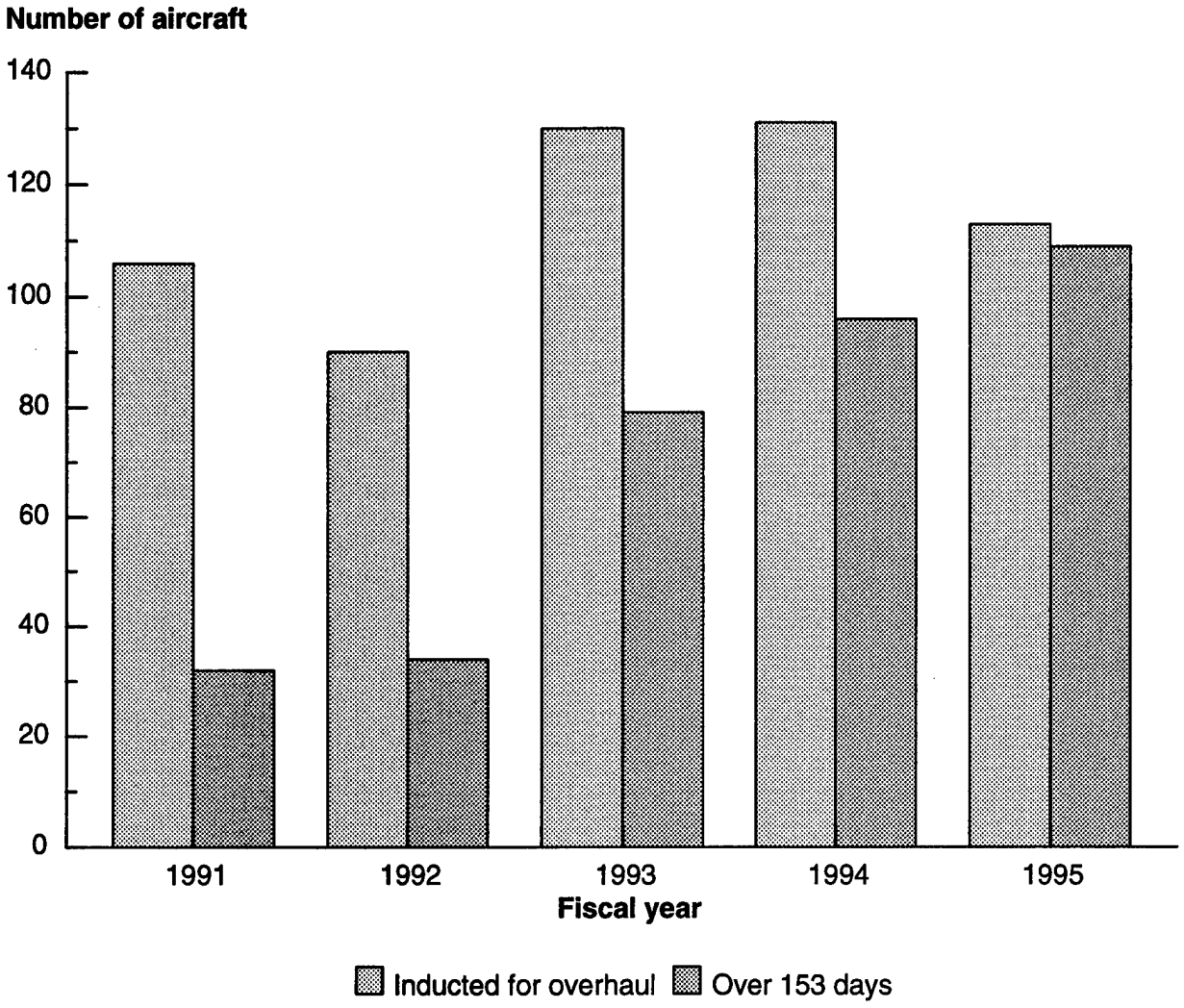
Increase in Time and Costs for Maintenance

The Air Force's goal to complete KC-135 depot overhauls is 153 calendar days. However, the actual time that KC-135s spent in the depot for maintenance increased significantly during the past 4 years. In fiscal year 1991, KC-135s spent an average of 158 days in the depot; by fiscal year 1995, that average had increased over 50 percent, to 245 days. Numerous aircraft have been in the depot for hundreds of days. For

example, the percentage of KC-135s spending over 300 days in the depot grew significantly during this period, from 6.6 percent of aircraft inducted (7 of 106) in fiscal year 1991 to 21.2 percent (24 of 113) in fiscal year 1995.

In addition, the number of aircraft exceeding the 153-day turnaround time goal has increased dramatically from 30 percent of the aircraft inducted in fiscal year 1991 to 97 percent in fiscal year 1995. Figure 2.2 shows the growth in the number of aircraft that have exceeded the 153-day goal between fiscal years 1991 and 1995.

Figure 2.2: Increase in KC-135 Depot Overhaul Time



Source: GAO analysis of Air Force data.

The Air Force cited the age of the aircraft and a lack of replacement parts as primary reasons for the increased maintenance time. Other contributing

factors included the lack of information about the condition of aircraft coming into the depot, and additional work required to detect, repair, and prevent corrosion. The Air Force indicated that, although the KC-135 design was considered state-of-the-art in the 1950s, design features of the aircraft make it vulnerable to corrosion damage. For example, when the planes were built, sealant was not applied between overlapping surfaces throughout the aircraft, and materials now considered susceptible to corrosion and stress corrosion cracking were used in the aircrafts' construction.

KC-135 depot maintenance time is significantly greater than that experienced by commercial airline fleets during their periodic heavy maintenance work, referred to as D checks, which most closely represents Air Force depot maintenance. We previously reported that D checks are performed every 3 to 9 years, and the maintenance time required ranges from 10 to 60 days, depending on the airline.[1] KC-135s have been sent to the depot for scheduled maintenance every 4 years, with an average stay of 245 days in fiscal year 1995. Even so, the interval for depot maintenance is now gradually being extended to 5 years.

Planned Depot Maintenance Work Has Grown

The planned labor hours needed to complete standard depot maintenance work on each KC-135 increased by about 6,300 labor hours (36 percent) between fiscal years 1991 and 1995. In fiscal year 1991, the standard work package, exclusive of any unplanned work, required about 17,300 labor hours. In fiscal year 1995, this work package labor hours increased to 23,600 hours. About 24,350 hours are planned for fiscal year 1997. This growth includes time to apply corrosion preventive compounds, remove and replace significant portions of each airplane's wiring, and completely strip the paint from each airplane.

Unplanned Maintenance Has Also Grown

Once aircraft structures and assemblies are opened and closely examined during maintenance, additional repairs or replacements of components and structures are frequently identified. According to an Air Force analysis of depot maintenance time for fiscal year 1994, unplanned work on the KC-135 added an average of 61 days per aircraft to depot maintenance on the aircraft. Significant portions of the KC-135s' fuselage skins have had to be replaced due to corrosion. Also, inspections revealed significant cracks in major structural components such as fuselage bulkheads and wing production breaks, which had to be replaced. In 1991, we reported that unforeseen, unscheduled maintenance accounts for nearly one-half of the

[1]Aircraft Maintenance: Additional FAA Oversight Needed of Aging Aircraft Repairs (Vol. I) (GAO/RCED-91-91A, May 24, 1991).

heavy airframe maintenance done on commercial aircraft.[2] Unscheduled maintenance increases to about 65 percent on aircraft over 10 years old and continues to rise as they get older. This situation appears to parallel the Air Force's experience in maintaining its older tanker fleet and suggests that its KC-135 maintenance costs and workload will continue to rise.

Some Depot Maintenance to Be Deferred Because of Rising Cost Estimates

Depot overhauls planned for nine KC-135 tankers during fiscal year 1996 will be deferred to fiscal year 1997 because actual maintenance costs are higher than budgeted amounts. Depot officials told us that between submission and execution of the fiscal year 1996 budget (about 18 months), additional tasks were added to the standard work package, and hourly labor rates increased by about $10. As a result, AMC will pay about $18 million more than planned for ongoing overhauls. Consequently, overhauls of nine aircraft were deferred to adjust for the increase.

Extended Depot Maintenance Reduces Tanker Operating Availability

When the number of KC-135s in depot maintenance exceeds 10 percent or 55 of the 552 current fleet, the squadrons have fewer aircraft than planned for operations. At any given time, however, about 70 to 90—or an average of about 15 percent—of the 552 KC-135s are undergoing scheduled maintenance. In the summer of 1995, 105 aircraft were in the depot—about twice the number planned for any one time. During our visit to Fairchild Air Force Base, Washington, 27 percent of the KC-135s were in depot maintenance.

Air Force Actions to Improve Aircraft Availability and Depot Turnaround Time

The KC-135 System Program Office at the Oklahoma City Air Logistics Center developed an Aircraft Sustainment Master Plan to identify actions required to sustain the C/KC-135 fleet. This plan includes efforts to assess the impact of corrosion on the operational and economic life of the aircraft.

The master plan cited replacement part shortages as a major cause of extended depot stays for KC-135s. More than 500 items were identified as critical to timely support. About 60 percent of these items had not been authorized for stockage, while the other parts had not been adequately stocked according to the Air Force. Stock levels of these items were increased to meet higher parts failure rates occurring due to the age of the aircraft. Critical items included fuselage skins and major structural

[2]Aircraft Maintenance: Additional FAA Oversight Needed of Aging Aircraft Repairs (Vol. I) (GAO/RCED-91-91A, May 24, 1991).

components. Outlays for these parts rose from $5.8 million in fiscal year 1992, to $70.6 million in fiscal year 1995. The Program Office believes sufficient parts will be on hand by the end of calendar year 1996 to reduce depot delays caused by parts shortages.

Lack of information about the condition of aircraft before they arrive at the depot has also extended depot maintenance time. To remedy this condition, the Air Force plans to thoroughly inspect each KC-135 about a year before it is scheduled for depot maintenance to identify the aircraft's condition, forecast major parts requirements, and reduce technical surprises once maintenance begins. A database is being created to track depot and field maintenance actions and inspection results, including corrosion information. This will improve the knowledge of each aircraft's maintenance history. Currently, there is no specific historical information available on rework and repairs accomplished on the C/KC-135 fleet.

Costs to Modify KC-135s Could Be Substantial

The Air Force could spend over $6.1 billion in the coming years to replace major structural components and other items to sustain the KC-135 and improve its reliability, maintainability, and capability. Although many of these modifications would not be required in a new tanker, most will probably be made because they will be needed to sustain the KC-135 fleet over several more decades. Table 2.2 lists these modifications and their estimated cost. Modifications costing about $1.1 billion have been funded.

Table 2.2: Possible KC-135 Modifications

Dollars in millions

Modification	Estimated cost
KC-135E engines	$3,772.0[a]
Structural components and aging items	1,717.8
Compass/radar/GPS (PACER CRAG)	386.5[b]
Multipoint refueling	203.9[b]
Ground collision avoidance system	19.5[b]
Automatic communication processor	29.0[b]
ARC-190 radio	22.3[b]
Total	**$6,151.0**

[a]About $436 million has been funded to replace engines on 20 aircraft. The Air Force is still considering whether to replace the engines on 139 additional KC-135Es.

[b]Funded.

KC-135E Engine Options Could Be Costly

Beginning by 2000, the Air Force could spend up to $600 million to overhaul or up to $3.3 billion to replace the TF33 engines on 139 Air Reserve Component (ARC) KC-135E tankers to keep them operational and reduce support costs.[3] The TF33 engines are used, refurbished commercial engines which, at current usage rates, will need a major overhaul around the turn of the century. This will include related repairs to cracked and corroded struts and engine shrouds.

Even if overhauled, the TF33 engines will not meet federal noise and pollution standards. The Federal Aviation Administration will impose even more stringent noise standards in 2000. Since many ARC aircraft operate from commercial airports, they could be subjected to operating hour restrictions or other penalties that could affect tanker operations and flexibility.

An option is to replace the TF33s with the CFM-56 engine, which according to Boeing meets noise and pollution standards, requires less maintenance, has more thrust, and is more fuel efficient. The increased thrust enables CFM-56-equipped KC-135s to take off from shorter runways (increasing basing options) and, when combined with better fuel efficiency, increases the amount of fuel available for offloading by about 25 percent. The Air Force is conducting a life-cycle cost analysis to determine the economic payback point for replacing the TF33 engines with CFM-56 engines. It will use this analysis to determine whether to modify the remaining ARC aircraft. The average replacement cost per aircraft is about $24 million.

Multipoint Refueling Capability Will Enhance Inter-Service Support

The Air Force plans to spend about $204 million ($33.5 million for research, development, test, and evaluation, and $170.4 million for procurement) to modify 45 KC-135s and buy 33 sets of wing refueling pods to add a "multipoint" capability to enhance cross-service refueling operations. Currently, the services lack standardized refueling equipment. When Air Force tankers refuel Air Force receiver aircraft, the boom operator maneuvers the tip of the tanker's centerline refueling boom into a receptacle built into the receiver aircraft's fuselage. In contrast, Navy, Marine Corps, and most allied receiver aircraft have a refueling probe that

[3]ARC tankers were fitted with the TF33 engine as a low-cost interim measure to improve performance and operating capability until the state-of-the-art CFM-56 engine could be installed. The Air Force is currently replacing the TF33 engines on 20 ARC KC-135E aircraft with CFM-56 engines at a cost of about $436 million. These aircraft represent the last of the KC-135s for which re-engining funds have been approved. The Air Force estimates that the last four aircraft will be completed in fiscal year 1998. By the completion of the currently approved program, it will have installed CFM-56 engines on 410 KC-135s.

the pilot maneuvers into a funnel-shaped drogue basket mounted at the end of a hose trailing from the tanker. For KC-135s to refuel probe-equipped receivers, a short hose and basket adapter is added to the end of the boom before flight. However, with the adapter installed, KC-135s cannot refuel Air Force aircraft. This current arrangement complicates mission planning and operations involving both types of receiver aircraft.

The multipoint modification will alleviate these problems. Two wing-mounted pods containing a retractable hose and refueling drogue will be installed on some KC-135s, enabling modified tankers to simultaneously refuel two probe-equipped Navy, Marine Corps, or allied aircraft during joint operations. The modified tankers will retain the boom to refuel Air Force aircraft.

DOD Could Enhance Operational Flexibility With a Dual-Role Tanker/Cargo Aircraft

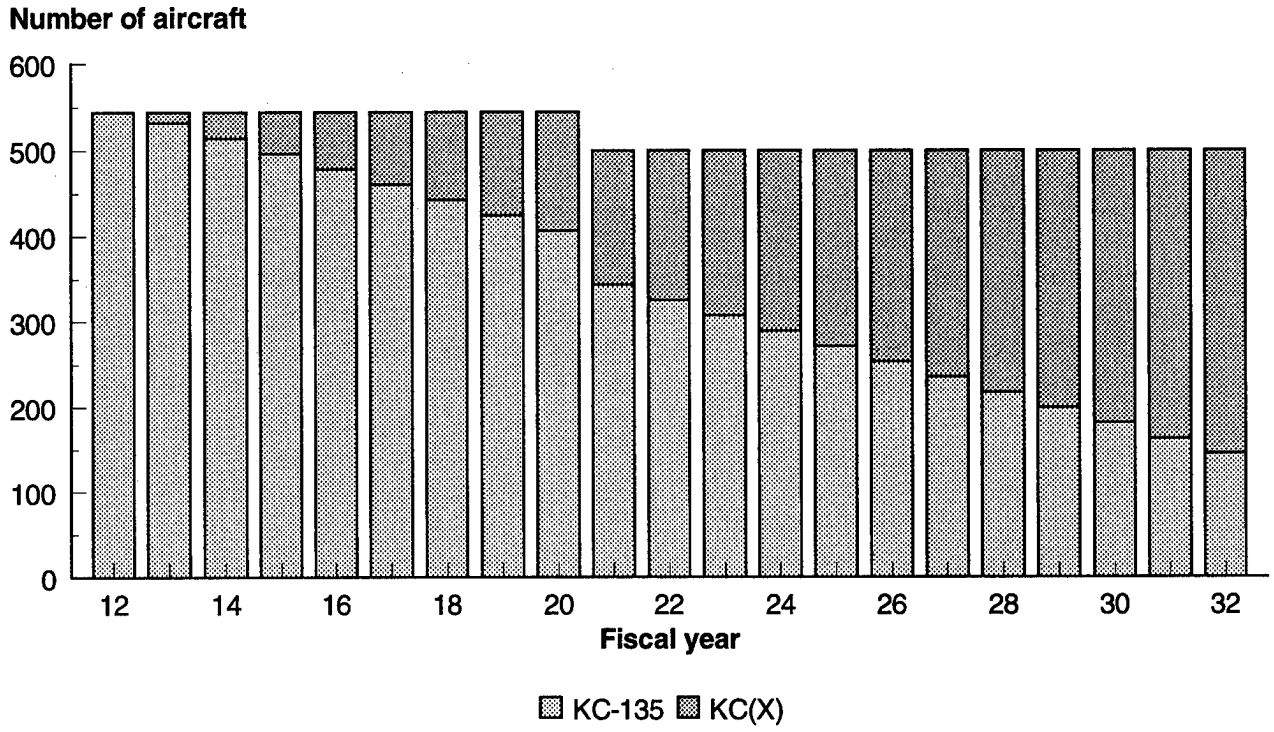
Although the Air Force has not yet determined the remaining economic service life of either the C-5A airlifter or the KC-135 tanker, the Air Mobility Command has placed a higher priority on replacing the C-5A beginning in fiscal year 2007, while deferring the start of a KC-135 replacement from fiscal year 2007 to 2013. Since procurement of a commercial-derivative aircraft could take as long as 4 to 6 years and development of a new military aircraft could take up to 12 years, the Air Force will need to quickly initiate studies to develop a replacement strategy for mobility aircraft. We believe that a dual-role cargo/tanker replacement may satisfy both needs. Current tanker aircraft like the KC-10, the KC-135, and the KC-130 have already demonstrated the versatility and value of a dual-role aircraft. They have also shown the viability of using a commercial design since the KC-10 was derived from the commercial DC-10 and because both the Boeing-built KC-135 and its commercial 707 were developed from a common design.

AMC, in its 1996 Air Mobility Master Plan (October 1995), which reflects the Command's future vision and detailed plans for its total force, expressed doubts that the KC-135 could continue to operate economically over the next 25 years, to about 2020, because of corrosion. Although 2020 is a much shorter period than the 2040 date reflected in the 1995 Air Mobility Master Plan, AMC deferred the start of the planned KC-135 replacement from 2007 to 2013. At the same time, it accelerated plans to replace the C-5A aircraft beginning in 2007. AMC, concerned about the economic life of the C-5A, cited the airlifter's high operational and support costs and low

readiness and reliability as reasons to begin studying a replacement for the C-5A.

Aging KC-135s will eventually have to be replaced. A replacement tanker will be expensive—preliminary cost estimates range from about $100 million to $150 million each—and will compete with other acquisition programs. However, some Air Force officials indicated that replacement may be less than one-for-one. Nevertheless, several hundred new aircraft will have to be procured to replace over 550 KC-135s. If replacement does not begin until 2013, and only a limited number of new aircraft are procured annually, many KC-135s will be retained well past 2020. Figure 2.3 shows a tanker force mix projected by AMC if 12 new aircraft were delivered in 2013, with 18 aircraft delivered each year thereafter. At that rate, the Air Force would have only 138 new aircraft by 2020, with 406 KC-135s remaining.

Figure 2.3: KC-135/Replacement Tanker Force Mix



Source: GAO analysis of Air Force data.

The eventual need to replace both KC-135s and C-5As presents the Air Force with an opportunity to possibly meet air refueling and airlift needs with a single type of aircraft. A significant portion of the cost to acquire separate tanker and cargo aircraft might be avoided if the Air Force considered one type of aircraft capable of filling both airlift and tanker needs. It has already demonstrated the value, versatility, and feasibility of dual-mission capability in its KC-10 aircraft. The KC-10 is a swing role tanker/airlift aircraft that can be used to refuel aircraft and carry cargo simultaneously, or perform either mission exclusively. It has a 342,000 pound fuel capacity and can be refueled in flight itself, thus extending its

range and the time it can remain airborne. It can carry 79 passengers and crew, and up to 170,000 pounds of oversized and bulk cargo. According to AMC, the KC-10 provides 13 percent of the total U.S. military organic airlift capacity. In Operations Desert Shield/Desert Storm, KC-10s conducted over 12,200 air refuelings and offloaded 297.6 million pounds of fuel (25 percent of the total), carried 53.7 million pounds of cargo, and transported over 6,700 passengers.

Compelling reasons to consider a joint cargo/tanker aircraft include the added utility of this combination, airframe commonality, increased reliability and maintainability, and the reduced operating and maintenance expenses of modern aircraft. Improved reliability and maintainability increases the number of aircraft available for operations, thereby increasing the effectiveness of a smaller force. The operating and support costs of a modern state-of-the-art aircraft can be far less than the 1950s vintage KC-135 because, in part, a new aircraft incorporates modern manufacturing techniques and stronger, more corrosion-resistant and fatigue-resistant materials.

Conclusion

Although the services' air refueling tanker aircraft meet current needs, satisfying future requirements may be difficult. The long-term serviceability of the KC-135 tanker fleet is questionable, as the aircraft are 30 to 40 years old and are taking progressively more time and money to maintain and operate. Furthermore, the Air Force could spend over $6 billion in modifications and structural repairs to keep the KC-135 fleet operational. However, even though the Air Mobility Command doubts that the KC-135 can be economically operated beyond 2020, it has delayed consideration of a replacement program until around 2013 because it considers replacement of the C-5A transport by 2007 a higher priority. Although service officials say they cannot currently afford to acquire a new tanker, the Air Force must eventually replace the KC-135. As the Air Force considers replacing its C-5A, it has an opportunity to enhance operational flexibility by acquiring a multiuse aircraft that combines transport and refueling capabilities. The Air Force now plans to buy both a new transport aircraft to replace its C-5A and a new tanker later to replace the KC-135. Since tanker aircraft are also used as cargo aircraft, such as in the case of the KC-10, a dual-use aircraft is a viable option.

Recommendation

Because the services have successfully used variants of commercial aircraft for both air refueling and cargo missions, we believe that a

dual-use replacement aircraft could fulfill both airlift and air refueling missions. Accordingly, we recommend that the Secretary of Defense require that future studies and analyses of replacement airlift and tanker aircraft consider accomplishing the missions of the C-5A and KC-135 with a dual-use aircraft that, when combined with C-5Bs, C-17s, and KC-10s, will meet those requirements. This could eliminate the need to acquire two aircraft types, one for airlift and the other for refueling.

Agency Comments

DOD agreed that future analyses regarding replacement of refueling or airlift aircraft should include a study of accomplishing the dual mission of airlift and refueling with one aircraft. However, it was concerned about how a dual-use aircraft would be used and whether one mission area might be degraded in order to accomplish the second mission. Accordingly, it would not commit to a dual-use aircraft until future analyses are done on operational issues and on the potential performance of a dual-use aircraft fulfilling both airlift and refueling missions and meeting deployment and employment requirements.

We agree that future analyses should address operational issues and whether a dual-use aircraft, used in conjunction with other air mobility assets, can perform both the airlift and aerial refueling mission, either separately or concurrently, without jeopardizing either mission. Such analyses will necessarily encompass a wide range of issues, including the air mobility requirements for deployment, employment, sustainment, and redeployment of U.S. forces; current and planned capacity, capability, and force structure; enroute and in-theater basing and infrastructure; and reliability, maintainability, and supportability.

Although DOD asserted that there are opposing requirements between the airlift and refueling missions, the KC-10, through its ability to either perform each mission exclusively, or perform both missions simultaneously, has demonstrated the value and flexibility of dual-use aircraft. We believe that a properly sized force of dual-use replacement aircraft, used in conjunction with other air mobility assets such as the C-17s, could meet airlift requirements, while still providing necessary air refueling. Like the KC-10, that replacement could perform these missions exclusively or concurrently, depending on the circumstances and conditions at hand. We believe there are a range of alternative aircraft that could be considered for a dual-use replacement.

Peacetime Activities Are Stressing the Tanker Fleet's Support Capabilities

With more than half of the Air Force's KC-135s in its possession, ARC units augment the active force in war and peacetime, as needed.[1] As the demand for air refueling has not diminished in proportion to the reduction in the number of tactical aircraft, the Air Force is increasingly relying on ARC to provide air refueling for peacetime missions. Because the United States has been involved in contingency operations in remote areas of the globe, tanker aircraft are frequently called on to refuel previously forward-deployed military aircraft as they fly to and from their destinations and to facilitate and sustain the performance of their mission once they are in place.[2] Meeting these demands has meant higher deployment rates for the active force and an increased share of the refueling workload for ARC. The ARC is able to meet these commitments through high volunteerism rates. However, the increased peacetime workload is stretching reserve crews' availability far beyond the point (38 days) that they are legally required to train.

Increased Peacetime Activity Results in High Deployment Rates for the Active Force

As the Soviet threat collapsed, the U.S. military faced new operating realities. Although the overall size of U.S. forces, defense budgets, and overseas presence have been significantly reduced, U.S. forces continue to deploy for traditional combat training and to participate in contingency operations. This has resulted in increased deployments that have stressed active duty service members who must spend longer temporary duty assignments away from home.

Since Operations Desert Shield and Storm, the Air Force has asked ARC to support a number of contingency operations. These contingency operations include Provide Comfort (northern Iraq), Uphold Democracy (Haiti), Restore Hope (Somalia), and Deny Flight (Bosnia). In December 1992, as part of Operation Restore Hope, 381 AFRES volunteers were placed on active duty for 31 days, flying 190 sorties, airlifting 1,076 passengers and 1,504 tons of cargo, and offloading nearly 1.8 million pounds of fuel in flight. Similarly, during the last quarter of fiscal year 1994 and the first quarter of fiscal year 1995, ANG provided 1,071 tanker personnel and 37 aircraft for Deny Flight operations.

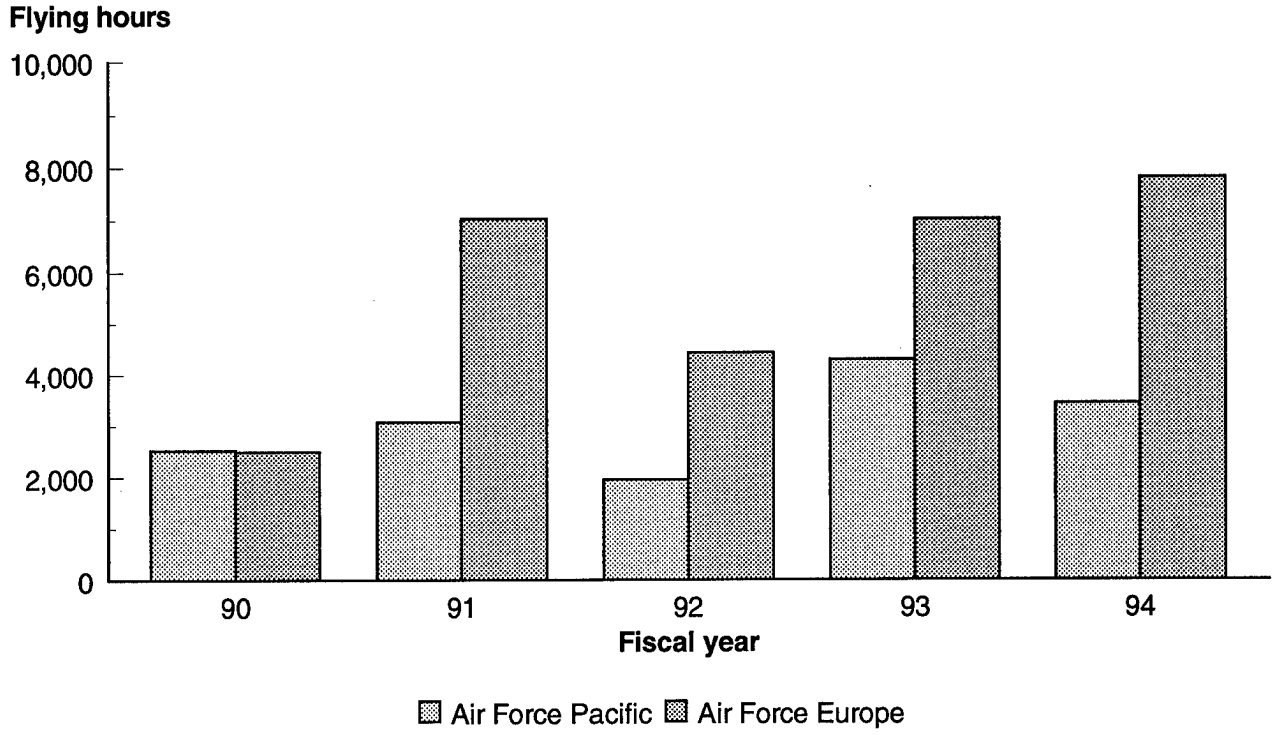
[1]The ARC comprises the Air National Guard (ANG) and Air Force Reserve (AFRES), created in 1947 and 1948, respectively. Under 10 U.S.C. 10102, ARC members can be mobilized to augment the active Air Force during a war or national emergency or as the national security may require.

[2]Contingency operations are military operations that exceed the routine deployment or stationing of U.S. forces abroad but fall short of large-scale theater warfare.

Air Force officials also told us that the drawdown of U.S. forces from overseas bases has added to air refueling requirements because of the need to refuel U.S.-based tactical aircraft to enable them to reach and return from their overseas destinations and to facilitate their performance and sustainment of their missions once they are in place. According to AMC officials, before Operations Desert Shield and Storm, contingency operations accounted for less than 2 percent of the total air refueling activity. Since then, these operations have accounted for an average of more than 20 percent of the mission. In addition, contingency air refueling directly contributed to actual flying hours exceeding planned flying hours by an average of 11 percent in the post Desert Shield/Storm era. Figure 3.1 shows the increase in air refueling activity of the European and Pacific Commands since 1990.[3] Other factors also contributed to the increased air refueling demand. For example, since the drawdown of U.S. forces, the F-16 has become the primary fighter aircraft in the European Command. Because it cannot fly as far as other fighters without being refueled, it is more dependent on tankers than, for example, was the F-111. Thus, while fewer fighter aircraft are in the theater, those remaining are more dependent on tankers than before. In addition, because fewer units are based in Europe, ongoing missions such as the Bosnian operation require the periodic rotation and replacement of personnel, equipment, and supplies, and each trip across the Atlantic requires tanker support.

[3]These operating commands are directly affected by the drawdown from overseas bases. In addition, a number of recent contingency operations have operated from the European Command's theater of operations. It should be noted, however, that due to limitations in AMC's historical tanker reports, the level of tanker activity occurring in Europe Command's theater is understated. It includes no tanker activity of ARC units, or of other commands' assets temporarily under the operational command of the Europe Command. Further, tanker activity supporting Southern Watch, an operation directed by Central Command, is reported by the various participating commands that own the tanker assets employed in the operation.

Figure 3.1: KC-135 Flying Hours in Overseas Commands



Source: GAO analysis of Air Force data.

Because of the increase in peacetime activity, active duty tanker crews are spending significant amounts of time on temporary duty away from their home stations. In February 1995, the Secretary of the Air Force and the Chief of Staff jointly testified before Congress that active duty personnel deployments increased four-fold over a 4-year period. In fiscal years 1994 and 1995, the deployment rates for individual tanker crew members, particularly navigators, approached the 120-day management limit, ranging from 103 to 117 days, depending on crew position.[4] We recently reported that, with the exception of the Navy, unit personnel described a variety of stresses on individuals and families of high-deploying units in the active

[4]Currently there is an Air Force-wide shortage of navigators.

force, including difficulties in financial management, retention problems, high divorce rates, substance abuse, and career hardships.[5]

Reserve Component Is Performing More Refueling Missions

To hold the line on active duty deployment rates, the Air Force has increasingly relied on ARC volunteers to take on more and more of the workload. In fiscal year 1993, ARC crews flew 27 percent of the total sorties and 30 percent of the total flying hours flown by ARC and AMC. In fiscal year 1995, ARC flew 44 percent of the total sorties and 49 percent of the total flying hours flown by ARC and AMC. ARC officials indicated that ARC is currently operating at about 95 percent of its availability.

Today, ARC maintains more than half of the KC-135 fleet. By the end of fiscal year 1996, based on congressional direction, the active Air Force will have transferred about 296, or 54 percent, of the KC-135 tankers to ARC. With 19 tanker units and 224 aircraft, ANG has the majority of the ARC tankers; AFRES has 7 tanker units and 72 aircraft. A typical ARC tanker unit is comprised of a mix of part-time and full-time crews.

During peacetime, DOD may gain access to reservists in two ways. Under 10 U.S.C. 12304, the President may order reservists to serve on active duty involuntarily. Also, under 10 U.S.C. 12301(d), DOD can activate any reservist with his or her consent. Unless mobilized, ARC members cannot be required to serve more than 38 days in prescribed training activities to meet their service obligations.[6] However, it is not unusual for this largely part-time force to exceed this minimum training requirement. According to senior ANG and AFRES officials, traditional part-time reservists can reasonably expect to serve at least 110 duty days a year. This includes 50 days at the home unit and 60 days a year on deployment (time away from their jobs and families). According to an ANG training official, air crew generally train an additional 48 flying and flight training periods, 3 school training days on flight simulators, 1 exercise or deployment lasting 5 to 10 days, and a number of special training days, the length depending on the type of aircraft. In fiscal year 1994, KC-135 AFRES crews averaged 50 crew days away from the home unit; KC-135 ANG crews averaged 68 crew days away from the home unit, facilitated by high rates of volunteerism. In fiscal year 1995, the AFRES crews averaged 57 crew days away, while the ANG crews averaged 52 crew days away.

[5]Military Readiness: A Clear Policy Is Needed to Guide Management of Frequently Deployed Units (GAO/NSIAD-96-105, Apr. 8, 1996).

[6]According to DOD Directive 1215.6, AFRES personnel are required to serve a minimum of 38 training days a year, and ANG personnel are required to serve a minimum of 39 training days a year.

But the availability of individual reservists and reserve units to perform tanker missions can be limited by many factors. For an individual, these factors include whether the member has a full- or part-time civilian job, the nature of the job, and the willingness of the employer to grant time away from the job. According to the Air Force Reserve Commander's Review of 1995, a civilian who is not affiliated with the ARC would work approximately 221 days a year, leaving 144 days for nonwork activities. However, a typical air crew member works 221 days at a civilian job and approximately 100 to 120 days at the reserve job, leaving 24 to 44 days free time. Fulfilling these reserve duties may necessitate reservists' using their personal vacation time. The availability of the traditional Guard air crew members is also affected by civilian employment limitations, the influence of economic cycles, and can vary greatly among units. The state of the local economy and airline hiring directly affect aircrew availability. If civilian employment is down, part-time crew members without full-time civilian employment can serve more days in the reserves. When the economy is booming, and more jobs are available, this personnel resource is diminished.

The limited availability of ARC personnel also precludes them from supporting some longer term operations. For example, the Commander, Central Command, Air Force, requires that all personnel supporting Operation Southern Watch serve a minimum of 91 days in theater. This effectively precludes the use of ARC tanker units and personnel because ARC personnel are generally required to serve on active duty for only a 14-day period.

The Air Force has acknowledged that the limited availability of ARC personnel affects AMC in terms of contingency response time and operations tempo. According to the current Air Mobility Master Plan, the transfer of tanker and airlift aircraft to ARC lengthens AMC's contingency response time unless ARC is mobilized. Furthermore, the plan states that continuing mobility requirements and a high operations tempo will demand more from AMC active duty personnel, which may contribute to retention problems in the late 1990s.

Officials Say Active and Reserve Assignment Mix Needs Reevaluation

In a 1994 speech, General Fogelman, the Air Force Chief of Staff, responded to the question: Are we overtasking our people so they are not ready for combat? with the following remarks:

We do not have a hollow force problem . . . we have an OPTEMPO problem. We have some folks on the road too much . . . One of my challenges is to find ways to spread out the TDY burden . . . [One way may be to] redistribute some force structure between the Guard or Reserve and active duty units. . . . But, there is a limit on the amount of volunteerism we can expect from our citizen-airmen. . . . That's far too much."[7]

Several recent studies have discussed the high operating tempos currently associated with peacetime operations and use of the ARC to provide relief to the active duty units. In March 1995, we reported on the stress of high deployment rates that result from the repeated use of certain active duty support units', including specialized Air Force aircraft, extended participation in multiple and/or large scale peace operations. This also involved the use of the reserve forces to provide relief. Changing the mix of active and reserve units was one option suggested to DOD to allow it to meet the demands of peace operations.[8] A September 1995 Rand report on Air Force needs appropriate for responding to crises and lesser conflicts, suggested the option that more of the support forces needed for these operations be retained by the active component.[9]

Conclusion

As noted earlier, the Air Force Chief of Staff testified that in dealing with the issue of lowering the time personnel are away from home on deployment, the Air Force has looked to ARC to relieve active duty units in more mission areas than ever before. In fiscal year 1995, the reserve fleet flew almost half of ARC and AMC air refueling flight hours. They were able to do this because of the high rate of volunteerism. But ARC officials believe they are at about 95 percent of availability. In the last few years, ARC has been called upon more and more to support tanker missions of the active force. However, there may be a practical limit to the workload ARC can assume, because as the ANG KC-135 Operations Council noted in April 1995, "the Ops tempo has been sustained at a very high level for the past few years . . . [and] the ability to surge for other than real world emergencies is diminished."

[7]"Core Competencies — New Missions: The Air Force in Operations Other Than War", Gen. Ronald R. Fogelman, Chief of Staff, United States Air Force, remarks to the American Defense Preparedness Association Symposium, Washington, D.C., December 15, 1994.

[8]Peace Operations: Heavy Use of Key Capabilities May Affect Response to Regional Conflicts (GAO/NSIAD-95-51, Mar. 8, 1995).

[9]An Air Force for Crises and Lesser Conflicts, Carl H. Builder and Theodore Karasik, MR-626-AF, Rand, Santa Monica, California, 1995.

Comments From the Department of Defense

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3000 DEFENSE PENTAGON
WASHINGTON DC 20301-3000

ACQUISITION AND TECHNOLOGY

July 1, 1996

Mr. Richard Davis
Director, National Security Analysis
National Security and International
Affairs Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Davis:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "U.S. COMBAT AIR POWER: Aging Refueling Aircraft Are Costly to Maintain and Operate," dated May 29, 1996 (GAO code 701041), OSD Case 1161. The Department partially concurs with the report.

Overall, the report accurately portrays some of the challenges facing the KC-135 force in the coming years. The DoD believes that the current tanker force structure meets the requirement stated in the Defense Planning Guidance and will meet the requirements for the foreseeable future. While the KC-135 is an average of 35 years old, its airframe hours and cycles are relatively low. With proper maintenance and upgrades, we believe the aircraft may be sustainable for another 35 years. In FY 00, the Department will complete a KC-135 study aimed at corrosion problems, and other aging aircraft issues, to determine the service life. The study will help to provide a blueprint for the future.

Regarding the recommendation, the DoD agrees that future studies and analyses of replacing refueling or airlift aircraft should include an analysis of accomplishing the dual mission of airlift and refueling with one aircraft. However, until a study including operational issues is completed, the Department cannot commit to a dual-use replacement aircraft as fulfilling all airlift and air refueling mission needs.

Detailed DoD comments on the recommendation are provided in the enclosure. Suggested factual changes are being provided separately. The Department appreciates the opportunity to comment on the draft report.

Sincerely,

George R. Schneiter
Director
Strategic and Tactical Systems

Enclosure

GENERAL ACCOUNTING OFFICE DRAFT REPORT DATED MAY 29, 1996
(GAO CODE 701041) OSD CASE 1161

"U.S. COMBAT AIR POWER: AGING REFUELING AIRCRAFT ARE COSTLY TO MAINTAIN AND OPERATE"

RECOMMENDATION

RECOMMENDATION: Because the Services have successfully used variants of commercial aircraft for both air refueling and cargo missions, the GAO believes that a dual-use replacement aircraft could fulfill both airlift and air refueling missions. Accordingly, the GAO recommended that the Secretary of Defense require that future studies and analyses of replacement airlift and tanker aircraft consider accomplishing the missions of the C-5A and KC-135 with a dual-use aircraft that, when combined with C-5B, C-17, and KC-10 aircraft, will meet those requirements. The GAO asserted that this could eliminate the need to acquire two aircraft types, one for airlift and the other for refueling. (p. 8, p. 35/GAO Draft Report)

Now on pp. 7, 32-33.

DoD RESPONSE: Partially concur. As the GAO points out, the Department has had some success using a single aircraft for both airlift and refueling in a specific employment context (e.g., the KC-135 is configurable for low-volume high-priority cargo). However, the Department is not confident that a dual-use replacement aircraft could successfully supplant both the C-5A and the KC-135 because of opposing requirements between the airlift and refueling missions. For example, a smaller fleet of jumbo aircraft, such as a C-5, could provide a total off-load of fuel comparable to a much larger fleet of KC-135 sized aircraft, yet the timing requirements of an air campaign may require a much larger fleet of more efficient KC-135 sized aircraft. The Department's prime concern with a dual-use aircraft is that one mission area may be inappropriately degraded in order to incorporate the second mission. The Department would proceed with a dual-use commercial variant only if the trade-off between the airlift and refueling mission is acceptable in the context of full employment/ deployment plans. In summary, the Department concurs that future analyses regarding replacement of refueling or airlift aircraft should include a study of accomplishing the dual mission of airlift and refueling. The Department, however, does not necessarily concur "that a dual-use replacement aircraft could fulfill both" of these missions. As the Department approaches the replacement of the C-5A aircraft, these dual use concepts and trade-offs will be studied in detail.

Air Force and Navy Air Refueling Systems

The Air Force, Navy, and Marine Corps use two different refueling systems. Air Force fixed-wing aircraft employ a boom/receptacle refueling system. A telescoping tube, or boom, is mounted near the tanker aircraft's tail while the aircraft to be refueled (receiver aircraft) is equipped with a matching receptacle. During refueling, the receiver aircraft's pilot positions the aircraft below and behind the tanker aircraft. The boom operator aboard the tanker then extends the tip of the boom into the receiver aircraft's receptacle. The Air Force originally adopted this system because its relatively high fuel transfer rate was well suited to refueling larger aircraft such as the bomber fleet.

In contrast, Navy, Marine Corps, and most allied fixed-wing aircraft as well as all air-refuelable helicopters (including Air Force helicopters) use a probe/drogue system. During air refueling, the tanker aircraft trails a flexible hose that ends in a funnel-shaped drogue basket.[1] To refuel, the pilot of the receiver aircraft or helicopter approaches the basket and inserts a pipe (the probe) mounted on the receiver aircraft into the basket.

The Air Force's KC-135s—the most common tanker—are equipped with centerline refueling booms. Therefore, boom drogue adapter kits must be installed on the booms prior to the aircrafts' takeoff to enable them to refuel Navy, Marine Corps, and allied probe-equipped aircraft. Thus, to properly support operations involving mixed groups of Air Force, Navy, Marine Corps, or allied aircraft, tanker planners must ensure that enough tankers are provided to offload the amount of fuel needed and that the tankers are properly configured for the type of aircraft to be refueled. The KC-135s cannot refuel Air Force or allied receptacle-equipped aircraft when the adapters are installed. KC-10 tankers are equipped with a single hose and drogue in addition to their booms and, as a result, can refuel probe- and receptacle-equipped aircraft on the same mission. In addition, 20 KC-10s are being modified to accept wing-tip mounted pods that allow the aircraft to refuel two probe-equipped aircraft simultaneously.[2]

[1]The hose is stored on a reel mounted in a wing pod or within the aircraft, depending on the type of aircraft, when refueling operations are not underway.

[2]A total of 15 pod kits will be bought.

Locations Visited

During our review, we visited the following locations:

Washington, D.C., Area	• Office of the Secretary of Defense • Office of the Chairman, Joint Chiefs of Staff • Headquarters, U.S. Air Force • Office of the Chief of Naval Operations • Headquarters, Marine Corps • National Guard Bureau • Headquarters, Naval Air Systems Command • Air National Guard Readiness Center • Commission on Roles and Missions of the Armed Forces • Institute for Defense Analysis
Eglin Air Force Base, Florida, Area	• Headquarters, U.S. Air Force Special Operations Command • 9th Special Operations Squadron • 20th Special Operations Squadron
Honolulu, Hawaii, Area	• Headquarters, U.S. Pacific Command • Headquarters, U.S. Pacific Air Force • Headquarters, U.S. Pacific Fleet • Headquarters, Fleet Marine Force Pacific • Headquarters, Hawaii Air National Guard • 203d Air Refueling Squadron
MacDill Air Force Base, Florida	• Headquarters, U.S. Central Command • Headquarters, U.S. Special Operations Command
Marine Corps Air Station, El Toro, California, area	• Headquarters, 3d Marine Air Wing • Marine Air Group 11 • Marine Air Group 16 • VMGR-352 • VMFA-235
Norfolk, Virginia, Area	• U.S. Atlantic Command • Air Combat Command • Headquarters, U.S. Atlantic Fleet • U.S. Naval Air Forces, Atlantic

	• Carrier Air Wing Eight • Carrier Air Wing Seventeen
Scott Air Force Base, Illinois	• Headquarters, U.S. Transportation Command • Headquarters, Air Mobility Command
Other Military Commands, Units, and Activities	• Headquarters, U.S. Air Force, Europe, Ramstein Air Base, Germany • Headquarters, U.S. Central Air Force, Shaw Air Force Base, South Carolina • U.S. Naval Air Forces, Pacific, San Diego, California • Carrier Air Wing Two, San Diego, California • Oklahoma City Air Logistics Center, Tinker Air Force Base, Oklahoma • 72d Air Refueling Squadron (Air Force Reserve), • 722d Air Refueling Wing, March Air Force Base, California • 92d Air Refueling Wing, Fairchild Air Force Base, Washington • 108th Air Refueling Wing (Air National Guard), McGuire Air Force Base, New Jersey • 163d Air Refueling Group (Air National Guard), March Air Force Base, California • 168th Air Refueling Squadron (Air Force Reserve), March Air Force Base, California • U.S.S. Mount Whitney • U.S.S. Theodore Roosevelt
Defense-Related Companies	• AEL Industries, Inc., East Alton, Illinois • Boeing Aircraft Company, Seattle, Washington • Frontier Technology, Inc., Santa Barbara, California • GE Aircraft Engines, Cincinnati, Ohio • McDonnell-Douglas Aerospace, Long Beach, California • McDonnell Aircraft Company, St. Louis, Missouri • RAND Corporation, Santa Monica, California • Sargent-Fletcher Company, El Monte, California

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